

Annual Report 2019

• **391** research
ideas funded
with DKK
1.233 million



**DANMARKS FRIE
FORSKNINGSFOND**
INDEPENDENT RESEARCH
FUND DENMARK

“Research prepares us for global crises”

- David Dreyer Lassen, Chairman of the Board,
Independent Research Fund Denmark

PREFACE

2019 saw excellent research and debates on the willingness to take risks and the societal impact of independent research, including a significant green momentum. Researchers applied for DKK 9.4 billion, which is the highest amount in three years.

Digitalization of the public sector, ‘soft robots’ expanding Danish robot technology to new research fields and markets, unprecedented health research to fight deadly diseases, artificial intelligence to speed up the green transition, behavioral research, and green accounting to show if national economies can handle a total transition to a sustainable future. These are some of the 391 ideas that Independent Research Fund Denmark supported with DKK 1.2 billion in 2019.

Through risk-willing research, the researchers push the boundaries of knowledge. The leading position of Danish research internationally testifies to the researchers’ ability to do just that, namely hunt new results through groundbreaking research that will add value to society now and in the future.

Research prepares us for global crises and contributes to an advanced, democratic

society. Danish research must take the lead, internationally as well. In a Danish context, strengths can be found within specialized fields of research, but especially across fields.

GREEN, INTERDISCIPLINARY FOCUS AND INTERNATIONAL COLLABORATION

Top-quality research and interdisciplinary focus where both judicial, economic, and technological aspects play a part will help us achieve the green transition.

Thus, Independent Research Fund Denmark makes possible research across fields. We will strengthen the interdisciplinary focus in 2020 with the so-called “Research Project 3” with a financial frame of up to DKK 8.3 million. Researchers can combine interdisciplinary sub-projects in one large overall project aimed at the green transition.

Through risk investment, Independent Research Fund Denmark supports original ideas and works to provide Danish researchers with a great opportunity to pursue pivotal research clues and collaborate with other researchers at an international level within many different research fields. It is vital to get the idea airborne at the precise moment where its value grows in the meeting with other excellent ideas.

This is partly why Independent Research Fund Denmark chose to enter into a partnership with The Swiss National Foundation in 2019 about a

pan-European means for independent research. The partnership is meant to strengthen research relations and collaboration between the two countries ranking first on the global ranking list of research.

Internationalization will keep Denmark on track, and we have to take the lead with new solutions, not least the green.

RESEARCHERS APPLIED FOR MORE FUNDS IN 2019

Both in 2018 and 2019 the International Research Fund Denmark’s appropriation made up 5.4% of the annual public research budget. The development has turned and is back at the 2015-level while the years 2016 and 2017 saw a decline in percent.

The status quo in the national budget grant for 2018-2019 did not result in a lower application frequency. On the contrary.

The researchers applied for DKK 1.2 billion more than in 2019 and sent 268 more applications, corresponding to a total amount of DKK 9.4 billion. This includes applications for DKK 2 billion for the Fund’s elite initiative, Sapere Aude: IRFD research leader grants.

INDEPENDENT THEMATIC RESEARCH BUDGET

Independent Research Fund Denmark has experienced a slight increase of approximately DKK 25 million in thematic funds in 2019

in comparison to 2018. Digital technologies with a budget of DKK 80 million made up the largest part of the total DKK 128 million for thematic research in 2019. And the pool is significantly increased in 2020 with a thematic research budget of DKK 385.1 million.

The thematic areas of research based on the political settlements on the annual research reserves bear witness to a strong wish to accelerate not least the green research.

To Independent Research Fund Denmark, it is immensely positive that the tied grants come with open tasks to attract a very wide array of original ideas.

That way we can utilize the researchers’ knowledge of where their research has the biggest impact, both research-wise and in society.

EVALUATION: INDEPENDENT RESEARCH AS A CATALYST FOR DANISH RESEARCH AND INDUSTRY

In 2019, the Fund evaluated its largest means, Research Project 1 and 2 for independent research. Three quarters of a billion DKK or approximately 70% of independent research funds are annually invested in this means. Among other things, the evaluation showed that the effects of independent research can be tied to societal impact and the establishment of new research areas of particular benefit to the industry.

One third of the RP1-projects and almost half of the RP2-projects lead to or are expected to lead to a collaboration with companies.

The evaluation also showed that researchers who receive grants from Independent Research Fund Denmark are more likely to be given larger grants from the European Research Council (ERC) or the Danish National Research Foundation.

The evaluation emphasized the value of independent research as a catalyst for Danish research and society.

MORE WILLINGNESS TO TAKE RISKS IN DANISH RESEARCH FUNDING

In the fall of 2019, Independent Research Fund Denmark and the think tank DEA put focus on the willingness to take risks in Danish research funding. The purpose was to identify factors beneficial to the groundbreaking, transformative research.

The report raised a concern about whether we have created a research system that hinders the research development and reduces the likelihood of new sciences and technological breakthroughs beneficial to the development of society at large.

Some of the reasons for the concern are to be found in the increasing number of researchers who face growing competition for research funds and positions.

Systems for assessment and reward together with the increased importance of the concentration of external research funds prompt a concern that researchers today might have stronger incentives to play it safe than to pursue risky and potentially groundbreaking research.

One of the main arguments for investing public funds in research is precisely to create a good framework for basic research, where a considerable amount of uncertainty is involved, and protect it from the demand that research must deliver results fast.

Are we running from that goal? We will continue the debate about risk appetite in 2020.

A GREEN 2020

In 2020 Independent Research Fund Denmark can look forward to granting DKK 340 million to green research. The accumulation of research ideas and talent within green research calls for Independent Research Fund Denmark to use its expertise to spot the best ideas and talents in the pool. The ones that can support the food chain to the benefit of public, strategic research as well as private research collaborations.

Almost every sixth Danish crown from Independent Research Fund Denmark already goes into green growth themes emphasized in RESEARCH2025, and the Fund has thus been a part of building capacity for the green research efforts.

Independent research will continue to play a crucial role in large strategic ventures of the future. It will do so by creating the foundation for research environments strong enough to lift politically oriented research areas at the high level that characterizes Danish research.

Small and medium-sized businesses with research needs, research-heavy industries, public and private funds, and universities express the need for strong, independent research in Denmark, and an independent fund for driving green ideas forward with risk investment funding. Furthermore, a diverse expert assessment from a panel of 84 acknowledged professionals, and a professional setup of international peer reviewers, will secure the most original ideas to solve the colossal climate challenges, also in 2020. In this area, Denmark has an international reputation and thus an obligation to push the development forward.

Denmark must be the vanguard of green transition.

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Front page and back page

Sapere Aude: DFF-Starting Grant 2019,
photography: Tariq Mikkel Khan

Sapere Aude: DFF-Starting Grant is aimed at providing excellent younger researchers with the opportunity to develop and strengthen their research ideas and to carry out a research project at a high, international level as leaders of a research team.

3 highlights in 2019

35 Sapere Aude research leaders gave direction to future research

Independent Research Fund Denmark gave out 35 Sapere Aude: IRFD research leader grants in 2019 amounting to a sum of DKK 208 million. That is the highest number of Sapere Aude research grants in three years.

The money has been granted within the framework of the Fund's Sapere Aude initiative. This initiative is meant to give excellent young Danish researchers the best possible chances of creating vital new research results.

The researchers sent out 343 applications and in total, they applied for more than DKK 2 billion for the Sapere Aude means.

Looking at the number of grants in proportion to the number of applications, we see that men and women had an almost equal chance of getting a share of the desired grants with success rates of 10.3% and 10% respectively.

The projects have been deemed particularly excellent and groundbreaking, and the 35 research leaders now have to put together a research group with several participants at a high international level.

At the same time, it is an important stepping stone for each research leader who will have good chances of receiving, for instance, the European Research Council Consolidator Grants.

258 RESEARCH LEADERS TO DATE

Independent Research Fund Denmark has offered the means since 2010 with a funding of 258 young research leaders to date. Of these 258 researchers, quite a few have begun careers as leaders of the Danish National Research Foundation's 10-year ventures at centers of excellence.

In a broad settlement, the parties of the Danish Parliament set aside approximately DKK 46 million of the National Budget for Independent Research Fund Denmark's career program for especially talented young researchers who are ready to develop their ideas and lead a research project at a high international level.

At the same time, Independent Research Fund Denmark increases the pool with about three times that amount.

Groundbreaking ideas within artificial intelligence and new digital technologies

In 2019, Independent Research Fund Denmark gave out DKK 80 million to artificial intelligence and new technologies, and DKK 50 million to the research field People and Society, including research exploring the relationship between man and technology.

The trend is clear. The projects show that new technologies accelerate the research processes and can animate far more data faster.

As a result, we see tremendous progress within basic science. By use of algorithms and machine learning it is possible to calculate consequences and, for instance, predict greener transportation routes and the extent of environmental problems in the world's forests.

INCREASING AMOUNTS OF DATA

With artificial intelligence, the amount of diagnostics data can also lead to faster and more precise diagnoses and treatment in the health care system. In particular, AI requires research on meta-learning and simulation that take bias into account to ensure the end-data. Likewise, effective algorithms can help discover fragile connections within large amounts of data.

A total of 22 projects promoted new technologies within many different research fields and gained a foothold in Danish research. The thematic funds for the area People and Society also put focus on the problems associated with, among others, the digitalization of the public sector.

The brand-new ideas of the highest scientific quality paint a picture of what is going to trend in the years to come, both concerning new technologies and the issues that arise in the meeting between people and technology. The findings will influence the public as well as the private sector.

10,000 research ideas for Denmark 2004-2019

In 2019, Independent Research Fund Denmark can celebrate the funding of 10,000 research ideas. 10,000 ideas that make up the foundation for vital research results and have made it possible for researchers to set the course for new goals.

During the last 15 years, Independent Research Fund Denmark has spotted razor-sharp ideas from Danish researchers.

Sugar beets are turned into plastic, new cancer treatments see the light of day, encryption of data becomes more advanced, and new technologies such as artificial intelligence let us have research results faster. Breakthroughs in the understanding of superchargers will change our use of electricity, which we all depend on.

Historically, research-heavy companies in Denmark base their business on the willingness of Danish researchers to pursue groundbreaking research ideas.

We rarely know the safe way to the end-result but in the Fund's lifetime, we have established that ideas in open competition for research funds ensure high quality. Combined with the Fund's professional assessment and risk investment funding, the outcome is both interesting and valuable.

WE KNOW THIS BECAUSE:

- independent research brings new funding through strategic partnerships at home and abroad.
- independent research grows and discovers new important research clues.
- users within society transform independent research to patents, business, new medicine and technology, and streamlining of the private and public sector – all of which is of immediate value.
- independent research is fundamental to scientific aspirations for acknowledgment.

Independent Research Fund Denmark helps shorten the distance between research and companies, decision-makers, and welfare institutions. We make it easier to find solutions to the colossal climate challenges together. We have to create optimum conditions for researchers to deliver solutions in the short run and inspire new research and opportunities in the long run.



2015 | Original ideas grow and create breakthroughs

Independent Research Fund Denmark asks 641 excellent researchers from 2005-2011 whether pursuing brand-new research ideas break the mold. 98% answers that their research creates breakthroughs while 97% states that it also opens the door to brand-new research questions, which can bring science one step further.
Source: Effect analysis 2015 TNS Gallup for Independent Research Fund Denmark.



2014-2018 | "Reversed" photosynthesis leads to green bioethanol

One of the great puzzles of science has been how to transform plant material into sustainable ethanol to be used by the industry as fuel for the transport sector. Researchers solve this puzzle with funds from Independent Research Fund Denmark. In this case, the researcher finds a special fungal enzyme that can increase activity by up to 100 times when mixed with green plant chlorophyll and exposed to a light source at the same time. The discovery might play a great role in the production of biofuel and biochemicals. The enzyme company Novozymes is interested in scaling up the research for industrial use and making the production of biofuel cheap and effective enough to pave the way for an environment- and climate-friendly energy source.



2004-2016 | World-class health care

World-class research leads to five top professional heart centers in Denmark. Today, all patients suffering a heart attack are taken directly to these expert units where angioplasties are performed around the clock. In Denmark, researchers are conducting the world's most comprehensive study of massive heart attack treatments where the patients are taken to specialized heart centers.*
Suspicion of an impending heart attack is still the number one reason for emergency contact with a heart center and involves ambulance transport, hospitalization, and supervision. In 2016, researchers suggest extended blood work in the ambulance. The new research makes it possible to diagnose patients quicker and rule out the risk of life-threatening heart attacks. The research contributes to safer and more effective hospitalization and reduces the use of resources and the number of admissions.

* The research was funded by The National Council of Medical Science, which became part of Independent Research Council Denmark, later Independent Research Fund Denmark.

10,000 research ideas for Denmark 2004-2019*



2018 | Futurology and ice-cold superchargers

Researchers will find out how supercharging properties behave. Through new theoretical studies and in close collaboration with experimental groups researchers strive to expose the mechanism behind high-temperature supercharging and ultimately suggest new useful supercharging materials. This research can change the energy sector and create a brand-new potential for our energy consumption and supercharging cable technology. Superchargers move electricity without any loss of energy and were discovered in 1911 by the Dutch physicist H. Kamerlingh Onnes who cooled mercury down to a temperature only a few degrees above absolute zero. At a temperature of 4.2 K (approximately -269 degrees Celsius), all resistance suddenly disappeared. Among other things, superchargers are used in high-speed trains in Japan but have to be cooled down to minus 260 degrees to work.



2014 | Among the top of the world

In 2014, an international panel established that 19% of the research articles written by the Fund's researchers are among the world's 10% most cited articles measured in the same period. At the same time, the articles are cited 80% above the average for all of the comparable articles. Researchers around the world are large-scale consumers of Danish top research.



2006-2018 | The advanced IT of the future

With more than DKK 70 million in independent research funds granted to them for groundbreaking research throughout their careers, leading researchers head advanced quantum technology for the development of future supercomputers. In 2018, Microsoft announces that it raises funds in the amount of DKK 100 million for manpower and equipment at the Technical University of Denmark and University of Copenhagen to participate in the race for the quantum computer and internet of the future. At the same time, Microsoft opens the Quantum Materials Lab in Lyngby.

*

In 2019, Independent Research Fund Denmark funds more than 10,000 research ideas from the period 2004-2019. The current number is 9,642 projects with expected funding of 400 research ideas in 2019. The numbers are estimated from 2004 at which time Independent Research Council was established. The Council changed its name to Independent Research Fund Denmark in 2017.

THEMATIC ARTICLES



Green transition Social robots Fund collaboration

Green transition requires interdisciplinary research

Understanding and tackling climate changes and global environmental problems requires researchers who are willing to take risks and who explore green transition across fields.

If we are to solve the climate problems it requires research on new technology. But we also need to put efforts into massive research on consumer behavior and behavioral changes, environmental reports as well as how we as human beings understand and relate to nature.

Many things indicate that the biggest challenge related to green transition is not lack of technologies but of knowledge of how we distribute said technologies.

In 2020, Independent Research Fund Denmark will allocate DKK 340 million to research on green transition.

One of our strengths in Denmark is that we can tackle the green transition based on excellent research in several collaborating fields. This is the only way we can achieve the knowledge necessary to initiate and understand the green transition.

VITAL METALS

Independent research also dares ask the difficult questions necessary to ensure that the solutions we want are even possible. For instance, a group of Danish and international

researchers is trying to find out whether we have access to enough vital metals to convert to renewable energy.

To thoroughly answer this question, researchers work across fields to understand both geopolitical, geographic, and industrial conditions that affect access to vital metals.

In the effort to find solutions to the many climate challenges and the environment, independent research and a willingness to take risks are particularly important.

Here the researchers get to work with unique ideas that, if explored, hold the potential to create even better solutions to the benefit of society than we ever dreamed of.

PLASTIC WASTE

Plastic is high on the agenda when we talk about green transition and solutions to environmental problems. The oceans are littered with plastic causing damage to wildlife and flora. Thus, it is obvious that we must limit the use of plastic as much as possible within the EU.

But if the majority of plastic waste is the result of poor waste management in Asia, then limited use of plastic packaging in the Danish Irma supermarket chain will not have much of an effect on the problem.

An interdisciplinary research project funded by Independent Research Fund Denmark in 2019 covers the effect of different initiatives to reduce plastic waste and the emission of greenhouse gases from plastic production.

The research project will not only create unique knowledge of the climate and environmental effects of different initiatives to reduce the use of plastic, but also help us understand how different initiatives will affect the Danish national economy.

ALL-ROUND UNDERSTANDING OF THE GREEN TRANSITION

Such an all-round understanding makes it easier to choose the right initiatives that are financially possible.

Developing new ideas and technology to the benefit of green transition is not the only purpose of research. Research must also question the solutions and how the green agenda affects us as people and as a society.

Will too much knowledge about the climate crisis give us climate anxiety and paralyze us? Do our initiatives to reduce our climate effect make a difference at all in the big picture?

Interdisciplinary research can answer those questions. Independent research provides the basis for venturing down new and better paths of green transition.

CASE 1

How do we best ensure sustainable use of plastic?

A new research project will attempt to answer that. The researchers will develop new models that can more precisely show the effects of different initiatives in a circular plastics economy.

More recycling, a ban on certain types of disposable plastic, and plastic made from biomass.

These are some of the EU initiatives to stop the use of plastic and the pollution of nature with plastic waste.

But what is the exact economic and environmental effect of the different initiatives? What initiatives make the biggest difference? And are there initiatives with only minimal effect?

Postdoc from the Department of Chemical Engineering, Biotechnology and Environmental Technology at the University of Southern Denmark Ciprian Cimpan hopes to answer these questions. He will do so by using the models he is going to develop in his new research project in collaboration with researchers from the Norwegian University of Science and Technology.

Plastic is high on the environmental agenda and in the EU, for instance, steps have been taken to reduce the use of plastic and increase recycling. Unfortunately, we lack models to show us the effects and the costs of the different initiatives, says Ciprian Cimpan.

PLASTIC PRODUCTION IS RESPONSIBLE FOR 15% OF THE GREENHOUSE GAS EMISSION

Projections show that if the consumption of plastic continues at the current rate, 20% of the crude oil pumped from the ground will go into the production of plastic in 2050. Today, 6% of the oil goes into plastic production. And plastic production will be responsible for 15% of the greenhouse gas emission.

Thus, we talk a lot about a circular plastics economy where plastic is recycled to a much greater extent. At the same time, certain types of disposable plastic have been banned to avoid plastic in the oceans, among others, explains Ciprian Cimpan.

People are also trying to find alternatives to crude oil as the base of plastic.

Ciprian Cimpan's new models will be based on life cycle analyses of plastic products in combination with socio-economic projections.

The models will make it easier to gain insight into the effects of the different initiatives on the amount of plastic produced and the emission of greenhouse gasses from plastic production.

A ban on disposable plastic in the EU, for instance, has a great signaling value, but the question is how much of an effect it will have on plastic in nature. The immense problems with plastic in the oceans are primarily caused by poor waste management in the developing countries, and that will probably change concurrently with the socio-economic change in those countries, explains Ciprian Cimpan.

If we use the models to do a calculation of the initiatives, we will know exactly how bans, recycling, and alternative development materials will affect the demand for new plastic, the amount of crude oil used to make plastic, and the greenhouse gas emission from plastic production.

Ciprian Cimpan hopes that his models will be of help to both the plastic industry in Denmark, which he is in close dialogue with, and to the decision-makers when they need to choose the solutions with the biggest environmental effects and the least economic implications.

Denmark to become the frontrunner of research on robots and artificial intelligence



THEMATIC ARTICLE

To ensure full benefit from the digital age it is necessary to explore possibilities, limitations, and ethical problems across research fields.

In 2019, Independent Research Fund Denmark allocated DKK 80 million to research on digital technologies.

This way researchers from a line of research fields had the opportunity to explore possibilities, limitations, and growth potential of robots, big data, and artificial intelligence.

At the beginning of 2020, the Ministry of Higher Education and Science launched *The National Robot Strategy – A good educational, research, and innovation policy framework for robot technology in Denmark*. Independent Research Fund Denmark is identified as a central actor in regard to finding solutions to large societal challenges through the use of robot technology.

DIGITAL RESEARCH FRONT

The digital technologies develop at lightning speed globally.

The rapid development affects the way we socialize as well as the way we design societies.

There is an increase in use of algorithms and big data to study everything from the risk of developing certain diseases to the risks of financial fluctuations in the world's stock exchanges.

To be able to keep up with this development, the Danish society needs strong research environments in the field of digital knowledge.

A HOLISTIC PERSPECTIVE

To be able to utilize the technological breakthroughs in the most expedient way there is a need for academic breath within research that allows us to think holistically. When we relate to the technologies and their effects on us and our society, ethical and sociological angles need consideration as well.

It is important to work with the technologies in Denmark. This way we ensure that potential ethical dilemmas relating to a given technology are thoroughly covered and that these technologies are safe to use.

Artificial intelligence must be studied across research fields to develop better algorithms and understand how artificial intelligence affects us and our society.

HUMAN-LIKE ROBOTS

The same is true for research on social robots. A human-like robot can revitalize demented

people while child-size robots can entertain at children's hospitals.

In the future, artificial intelligence might assist social workers in their decision-making processes or help health sector personnel diagnose patients.

To make the most of this development, research needs to work intensively with the interaction between robots and people. There is a need for research across research fields to develop algorithms that can help support people as reliably as possible and with as few errors and negative side effects as possible.

Independent and risk-willing research makes up the foundation for a broader and safer digital future with a basic understanding of how the digital age affects us and our society.

CASE 2

Social robots: How are they most carefully used?

With funding from Independent Research Fund Denmark an interdisciplinary research team is to gain insight into how social robots can and should be used, and how human-like robots will affect society. Technology, philosophy, anthropology, psychology, and neuroscience will melt together in a new project.

Det lyder måske en anelse science fiction agtigt, men de sociale og menneskelignende robotter er med hastige skridt på vej til at få en større og vigtigere rolle i vores samfund.

It might sound a little bit like something out of a science fiction movie, but the social and human-like robots are quickly becoming more important in our society.

A human-like robot revitalizes demented people, makes them talk more and relate experiences from their past. A child-size robot can entertain children in hospitals while an adult-size robot shows the parents around the ward. These are scenarios that we're likely going to see in the future.

Technology makes many things possible, but we also have to consider the consequences of technology and where to draw the line for the use of it. A new research project will help us figure that out.

Based on our methodology, Integral Social Robotics, we will begin with the value-based considerations. So instead of just asking what social robots can do, we will ask what social robots can AND should do, explains Johanna Seibt, professor at the University of Aarhus.

She will lead the research project *Robot-Mediated Learning and Socratic Robotics: New Forms of Experienced Sociality for Tutoring, Self-Edification, and Coaching*, which has been granted funds from Independent Research Fund Denmark.

CAN YOUNG PEOPLE LEARN EQUALLY WELL FROM A ROBOT?

In the research project, the researchers will focus on the interactions that a social robot will perform and ask the question: What interactions and what type of experiences can and should we attempt to realize through social robots?

Researchers who specialize in the development of social robots are part of the research

group, which also includes researchers from philosophy, anthropology, psychology, and neuroscience.

This way we ensure that we develop responsible and culturally sustainable applications from the beginning, explains Johanna Seibt.

Specifically, the researchers are going to find out how meeting a social robot affects young people in a learning situation compared to meeting a teacher.

Earlier research has shown that meeting a robot can have a positive effect on young people. In the new research project, Johanna Seibt and her research colleagues will compare the learning benefits of meeting a social robot, an online computer program, and a flesh and blood human being.

The research will provide us with knowledge of how we are affected by interaction with robots.



Independent, risk-willing research creates the basic knowledge that leads to great discoveries

Thus, independent research is the first link in the “fund food chain” ensuring that we move from new knowledge to societal impact in the form of for instance new treatments or technology. The fund collaboration on research efforts is important.

Curiosity, excellence, and risk appetite are keywords in Independent Research Fund Denmark’s funding for Danish research. Combined with a degree of luck and coincidence these three keywords have formed the basis of groundbreaking discoveries through the years.

Some of these discoveries have created new penicillin treatments for infections, cemented the beginning of the universe with the big bang, and given us an understanding of our genome’s chemical composition and of atomic structure.

We need independent, risk-willing research to make the discoveries we thought impossible.

Independent Research Fund Denmark primarily allocates small grants thereby favoring many young researchers. This way the Fund secures a multitude of talented young researchers prepared to create their first results.

This often leads to larger grants from other funds allowing the researchers to build on the results created through funding from Independent Research Fund Denmark.

FROM INDEPENDENT TO STRATEGIC RESEARCH

Great breakthroughs often begin with a small idea that can be studied through a small research grant.

But we also need to think about developing a close collaboration between independent research and strategic research. Strategic research focuses on finding the best solution to a specific challenge.

The goal is to move from the big, groundbreaking discovery to societal impact even quicker thereby letting us utilize the synergy effect and avoid gaps in research funding.

THE FUND COLLABORATION IN DENMARK

In 2019, collaborating with other funds has been an important theme to Independent Research Fund Denmark. The Fund has established a closer dialog with the Danish National Research Foundation and Innovation Fund Denmark and scheduled quarterly meetings. The Fund also had a visit from the Danish National Research Foundation’s new chairman of the board, Jens Kehlet Nørskov, who gave a presentation on the perspectives in the funding of strategic fundamental research.

We are looking forward to expanding the collaboration with the two public funds as well as private funds in the years to come.

NORDIC FUND COLLABORATION

The Fund has strengthened its collaboration across borders to promote the internationalization of research. At the Nordic level, the Fund has been the driving force behind the establishment of a Nordic program for interdisciplinary research under NordForsk with the participation of the Swedish Research Council, the Research Council of Norway, and the Academy of Finland.

The program is meant for research projects with participants from at least three of the contributing countries that create

collaborations between fields that are otherwise unlikely to cross, and where research contributes equally to the development of knowledge within each field.

At the first deadline for applications in 2019, the program got as many as 337 applications for funding of such projects.

The overwhelming number of applications testifies to a great Nordic demand for the opportunity to get funding for interdisciplinary research – and to the great potential for strengthening the collaboration between the Nordic research environments.

WITHIN EUROPE

Interdisciplinarity and collaboration across borders are keywords for Independent Research Fund Denmark.

At the same time, the Fund focuses on collaboration in Europe. Since 2012 the Fund has been a member of the research association Science Europe working to bring public, research financed organizations in the EU closer together and to give member organizations a voice in research policy debates at EU level.

In recent years the Fund has intensified its active participation in Science Europe’s activities, including working groups for Open Science and the future EU frame program for research and innovation, Horizon Europe.

Furthermore, in 2019, the Fund has been in dialogue with several foreign funds about the establishment of bilateral collaboration agreements to create ideal conditions for collaboration between Danish researchers and researchers from attractive research environments in potential partner countries.

More collaboration across borders and funds helps ensure that Danish research takes the lead when it comes to excellence, societal impact, and the courage to test wild ideas that might hold the potential to really change our understanding of the world and the way we do research in Denmark.

2019 IN FIGURES

APPLICATIONS AND GRANTS 2019

Independent Research Fund Denmark in figures 2019

Funds applied for, m. DKK	Funds granted, m. DKK *	Success rate	Applications	Grants	Success rate
9,410	1,233	13.1%	2,647	391	14.8%

*Funds granted is higher than national budget financing for 2019 since the number is including funding of return flow from previous grants.

DFF Humanities	Total	M	F
Funds applied for, m. DKK	1,378	703	675
Funds granted, m. DKK	165	61	104
Success rate	12%	9%	15%
Applications	361	193	168
Grants	50	23	27
Success rate	14%	12%	16%

DFF Social Sciences	Total	M	F
Funds applied for, m. DKK	965	650	314
Funds granted, m. DKK	125	91	34
Success rate	13%	14%	11%
Applications	272	183	89
Grants	44	28	16
Success rate	16%	15%	18%

DFF Technology and Production Sciences	Total	M	F
Funds applied for, m. DKK	2,032	1,564	468
Funds granted, m. DKK	272	204	68
Success rate	13%	13%	15%
Applications	527	405	122
Grants	74	59	15
Success rate	14%	15%	12%

DFF All councils except thematic research funds	Total	M	F
Funds applied for, m. DKK	8,233	5,747	2,485
Funds granted, m. DKK	1,106	771	335
Success rate	13%	13%	13%
Applications	2,356	1,651	705
Grants	356	252	104
Success rate	15%	15%	15%

DFF Natural Sciences	Total	M	F
Funds applied for, m. DKK	2,147	1,704	444
Funds granted, m. DKK	287	235	52
Success rate	13%	14%	12%
Applications	582	464	118
Grants	83	66	17
Success rate	14%	14%	14%

DFF Medical Sciences	Total	M	F
Funds applied for, m. DKK	1,621	1,059	562
Funds granted, m. DKK	236	162	74
Success rate	15%	15%	13%
Applications	588	388	200
Grants	99	71	28
Success rate	17%	18%	14%

DFF Cross-council committee*	Total	M	F
Funds applied for, m. DKK	90	67	23
Funds granted, m. DKK	21	18	3
Success rate	23%	26%	12%
Applications	26	18	8
Grants	6	5	1
Success rate	23%	28%	13%

*Applications and grants under the Cross-council committee have been assessed jointly by two of the five main councils. Therefore these are registered only under the Cross-council committee and not under the main councils

INDEPENDENT RESEARCH FUND DENMARK: Instruments in 2019

	Applications	Grants	Success rate	Success M / F %	Funds applied for, m. DKK	Granted funds, m. DKK	Success rate	Success M / F %	Avg. grant, m. DKK
DFF-Research Project 1	1,115	159	14.3%	15.2 / 11.5	2,942.9	423.6	14.4%	15.4 / 11.5	2.7
DFF-Research Project 2	482	67	13.9%	12.8 / 16.3	2,745.2	378.4	13.8%	12.7 / 16.3	5.6
Sapere Aude: DFF-Starting Grant	343	35	10.2%	10.3 / 10.0	2,038.6	208.1	10.2%	10.3 / 10.0	5.9
DFF-International Postdoc	191	33	17.3%	16.4 / 19.0	272.9	46.0	16.9%	16.1 / 18.4	1.4
Non-university research education (PhD)	49	9	18.4%	11.1 / 22.6	122.8	21.7	17.7%	11.3 / 21.5	2.4
DFF-Danish ERC Programme 2019	13	12	92.3%	90.9 / 100.0	10.1	8.8	87.2%	83.7 / 100.0	0.7
Research networks Humanities	38	5	13.2%	4.3 / 26.7	41.9	5.8	13.8%	4.8 / 27.9	1.2
Journals Humanities	9	5	55.6%	62.5 / 0.0	0.8	0.5	57.4%	64.9 / 0.0	0.1
International research stay Social Sciences	33	9	27.3%	21.1 / 35.7	9.4	2.5	26.3%	22.7 / 30.5	0.3
Clinician scientist position Medical Sciences	34	8	23.5%	21.4 / 25.0	42.1	8.8	20.9%	22.1 / 20.1	1.1
Pre-graduate scholarship Medical Sciences	48	13	27.1%	35.3 / 7.1	6.0	1.6	27.0%	35.1 / 8.0	0.1
Graduate Research Opportunities Worldwide (GROW)	1	1	100.0%	100.0 / 0.0	0.2	0.2	100.0%	100.0 / 0.0	0.2
Subtotal	2,356	356	14.7%	14.8 / 14.5	8,233	1,106	13.4%	13.3 / 13.4	3.1
DFF Thematic research – Digital technologies	148	23	15.5%	11.9 / 36.4	569.2	78.1	13.7%	10.5 / 30.7	3.4
DFF Thematic research - People and society	143	12	8.4%	8.5 / 8.3	608.2	48.7	8.0%	7.0 / 8.7	4.1
Subtotal	291	35	12.0%	10.8 / 14.2	1,177.4	126.8	10.8%	9.3 / 13.0	3.6
Total	2,647	391	14.8%	14.8 / 14.7	9,410.3	1,232.8	13.1%	13.0 / 13.4	3.2

INDEPENDENT RESEARCH FUND DENMARK: Councils and Instruments 2019

DFF Humanities	Applications	Grants	Success rate	Funds applied for, m. DKK	Granted funds, m. DKK	Success rate	Avg. grant, m. DKK
DFF-Research Project 1	78	9	11.5%	209.2	24.7	11.8%	2.7
DFF-Research Project 2	113	14	12.4%	665.3	81.4	12.2%	5.8
Sapere Aude: DFF-Starting Grant	56	5	8.9%	336.7	30.5	9.1%	6.1
DFF-International Postdoc	40	7	17.5%	55.8	9.7	17.4%	1.4
Non-university research education (PhD)	27	5	18.5%	68.4	12.8	18.7%	2.6
Research networks Humanities	38	5	13.2%	41.9	5.8	13.8%	1.2
Journals Humanities	9	5	55.6%	0.8	0.5	57.4%	0.1
DFF-Danish ERC Programme 2019	0	0	-	-	-	-	-
Total	361	50	13.9%	1,378	165	12.0%	3.3

DFF Natural Sciences	Applications	Grants	Success rate	Funds applied for, m. DKK	Granted funds, m. DKK	Success rate	Avg. grant, m. DKK
DFF-Research Project 1	319	41	12.9%	869.8	113.1	13.0%	2.8
DFF-Research Project 2	102	12	11.8%	597.5	70.3	11.8%	5.9
Sapere Aude: DFF-Starting Grant	96	14	14.6%	587.0	86.2	14.7%	6.2
DFF-International Postdoc	54	9	16.7%	77.4	12.4	16.0%	1.4
Non-university research education (PhD)	4	0	0.0%	9.6	-	0.0%	-
DFF-Danish ERC Programme 2019	7	7	100.0%	5.8	5.5	94.6%	0.8
Total	582	83	14.3%	2,147	287	13.4%	3.5

DFF Social Sciences	Applications	Grants	Success rate	Funds applied for, m. DKK	Granted funds, m. DKK	Success rate	Avg. grant, m. DKK
DFF-Research Project 1	83	13	15.7%	207.7	32.9	15.8%	2.5
DFF-Research Project 2	77	10	13.0%	419.4	52.4	12.5%	5.2
Sapere Aude: DFF-Starting Grant	46	4	8.7%	269.7	24.6	9.1%	6.2
DFF-International Postdoc	22	4	18.2%	32.4	5.6	17.2%	1.4
Non-university research education (PhD)	10	3	30.0%	25.5	6.4	25.2%	2.1
International research stay Social Sciences	33	9	27.3%	9.4	2.5	26.3%	0.3
DFF-Danish ERC Programme 2019	1	1	100.0%	0.5	0.5	100.0%	0.5
Total	272	44	16.2%	965	125	12.9%	2.8

DFF Medical Sciences	Applications	Grants	Success rate	Funds applied for, m. DKK	Granted funds, m. DKK	Success rate	Avg. grant, m. DKK
DFF-Research Project 1	345	53	15.4%	854.4	132.7	15.5%	2.5
DFF-Research Project 2	62	10	16.1%	309.4	50.7	16.4%	5.1
Sapere Aude: DFF-Starting Grant	64	6	9.4%	354.6	29.7	8.4%	5.0
DFF-International Postdoc	25	6	24.0%	36.0	8.7	24.2%	1.4
Non-university research education (PhD)	7	1	14.3%	16.8	2.5	14.6%	2.5
Clinician scientist position Medical Sciences	34	8	23.5%	42.1	8.8	20.9%	1.1
Pre-graduate scholarship Medical Sciences	48	13	27.1%	6.0	1.6	27.0%	0.1
DFF-Danish ERC Programme 2019	3	2	66.7%	1.9	0.9	48.5%	0.5
Total	588	99	16.8%	1,621	236	14.5%	2.4

DFF Technology and Production Sciences	Applications	Grants	Success rate	Funds applied for, m. DKK	Granted funds, m. DKK	Success rate	Avg. grant, m. DKK
DFF-Research Project 1	273	39	14.3%	759.4	109.0	14.4%	2.8
DFF-Research Project 2	120	19	15.8%	707.4	114.3	16.2%	6.0
Sapere Aude: DFF-Starting Grant	81	6	7.4%	490.6	37.1	7.6%	6.2
DFF-International Postdoc	49	7	14.3%	69.7	9.7	13.9%	1.4
Non-university research education (PhD)	1	0	0.0%	2.6	-	0.0%	-
DFF-Danish ERC Programme 2019	2	2	100.0%	1.9	1.9	100.0%	1.0
Graduate Research Opportunities Worldwide (GROW)	1	1	100.0%	0.2	0.2	100.0%	0.2
Total	527	74	14.0%	2,032	272	13.4%	3.7

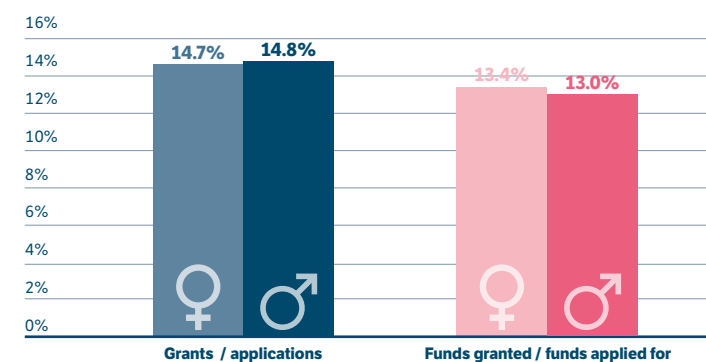
DFF Cross-council committee	Applications	Grants	Success rate	Funds applied for, m. DKK	Granted funds, m. DKK	Success rate	Avg. grant, m. DKK
DFF-Research Project 1	17	4	23.5%	42.3	11.3	26.6%	2.8
DFF-Research Project 2	8	2	25.0%	46.1	9.3	20.2%	-
Sapere Aude: DFF-Starting Grant	0	0	-	-	-	-	-
DFF-International Postdoc	1	0	0.0%	1.7	-	0.0%	-
Total	26	6	23.1%	90	21	22.8%	3.4

INDEPENDENT RESEARCH FUND DENMARK: Instruments and thematic research 2019

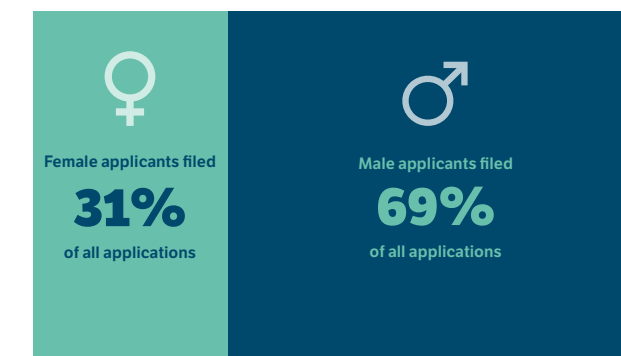
DFF Thematic research – Digital technologies	Applications	Grants	Success rate	Funds applied for, m. DKK	Granted funds, m. DKK	Success rate	Avg. grant, m. DKK
DFF-Research Project 1 (thematic research)	91	18	19.8%	253.0	48.8	19.3%	2.7
DFF-Research Project 2 (thematic research)	57	5	8.8%	316.2	29.3	9.3%	5.9
Total	148	23	15.5%	569.2	78.1	13.7%	3.4

DFF Thematic research - People and society	Applications	Grants	Success rate	Funds applied for, m. DKK	Granted funds, m. DKK	Success rate	Avg. grant, m. DKK
DFF-Research Project 1 (thematic research)	66	6	9.1%	174.9	17.0	9.7%	2.8
DFF-Research Project 2 (thematic research)	77	6	7.8%	433.3	31.7	7.3%	5.3
Total	143	12	8.4%	608.2	48.7	8.0%	4.1

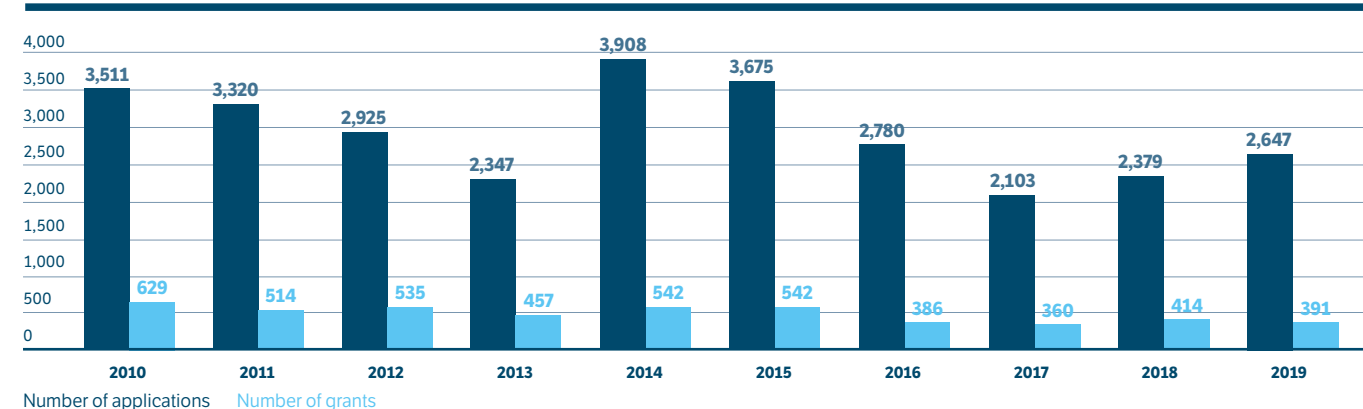
Independent Research Fund Denmark: Success rates based on gender 2019 (%)



Gender and applications

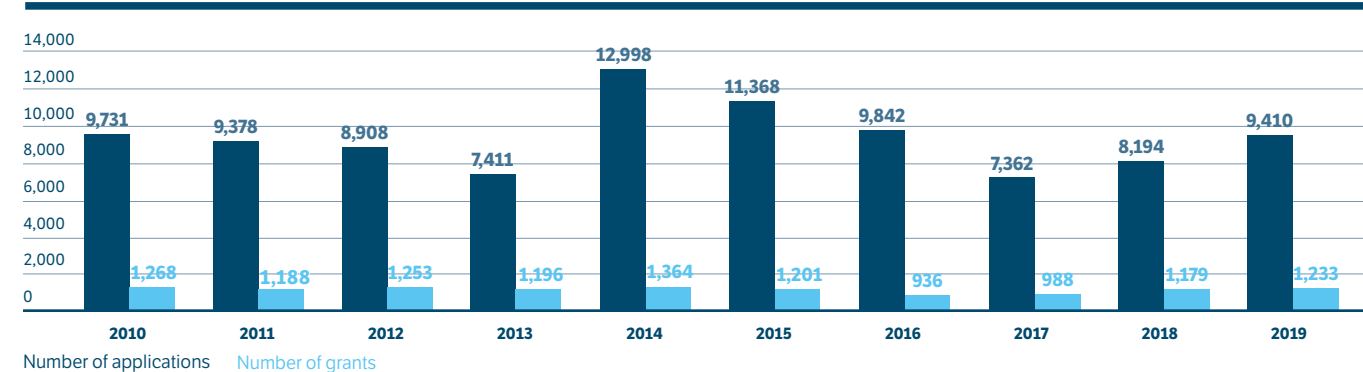


Independent Research Fund Denmark: Development in applications and grants 2010-2019 (number)

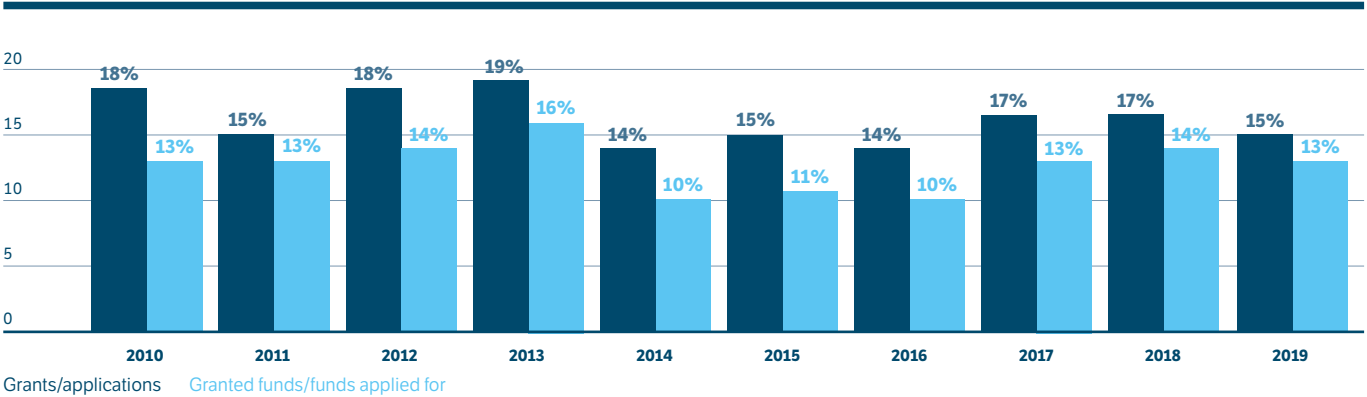


3.2 The average grant m. DKK

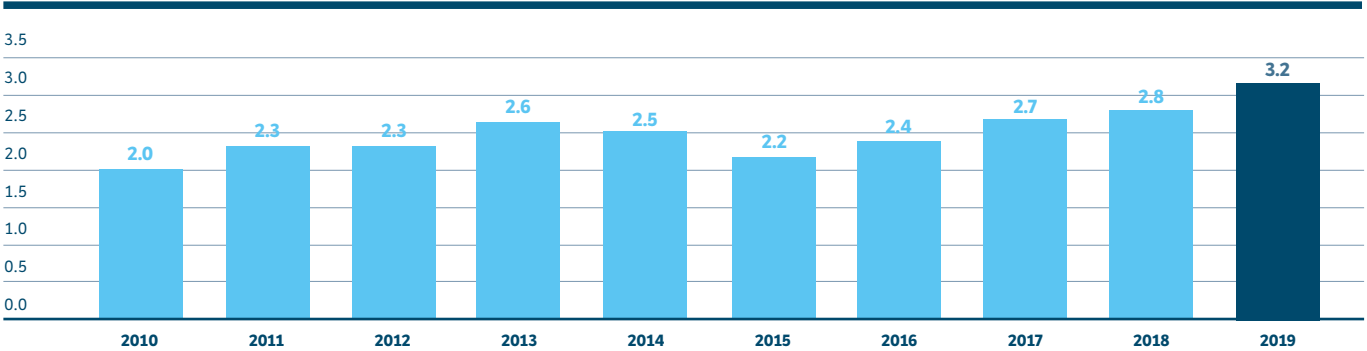
Independent Research Fund Denmark: Development in funds applied for and granted 2010-2019 (current prices, m. DKK)



Independent Research Fund Denmark: Development in average success rates 2010-2019 (%)

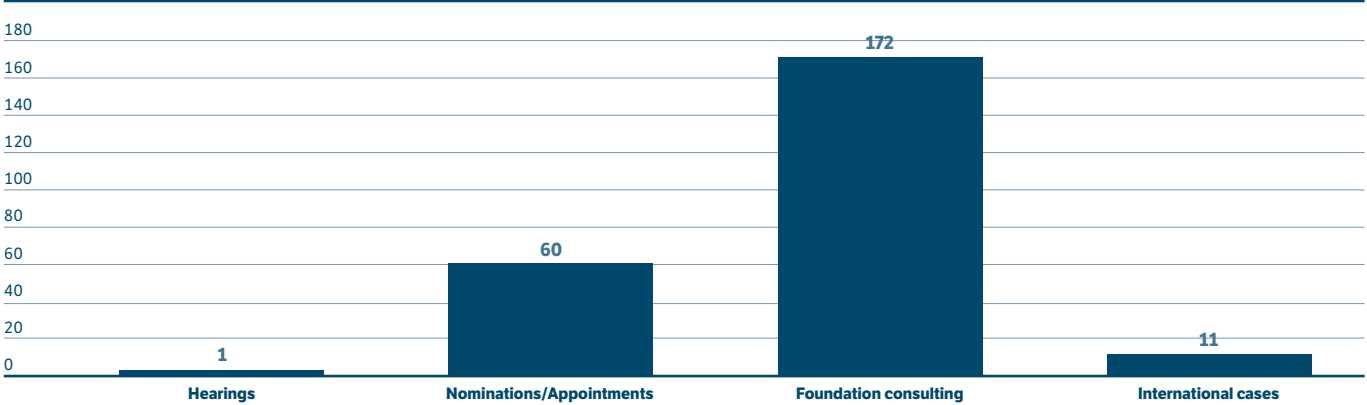


Independent Research Fund Denmark: Development in average grant sizes 2010-2019 (current prices, m. DKK)



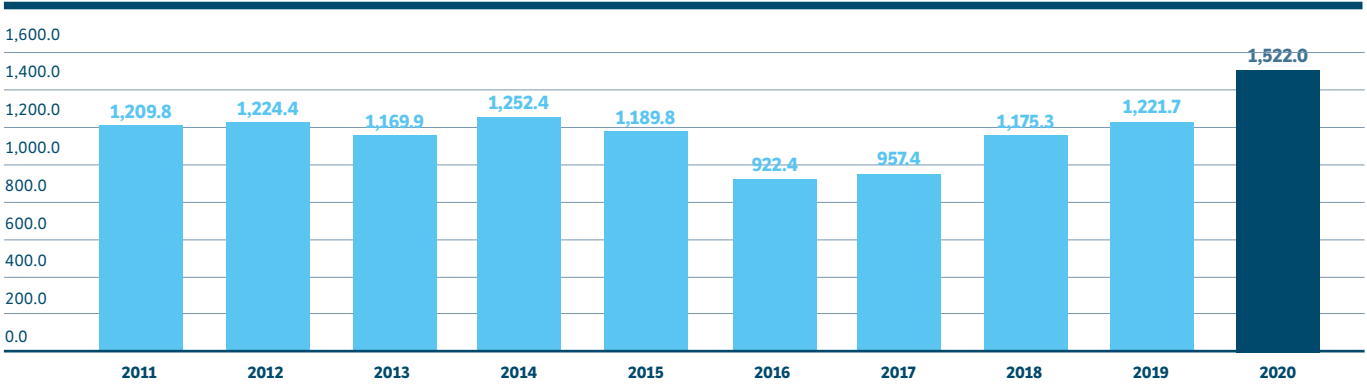
COUNCELING

Independent Research Fund Denmark: Advisory services 2019 (number)

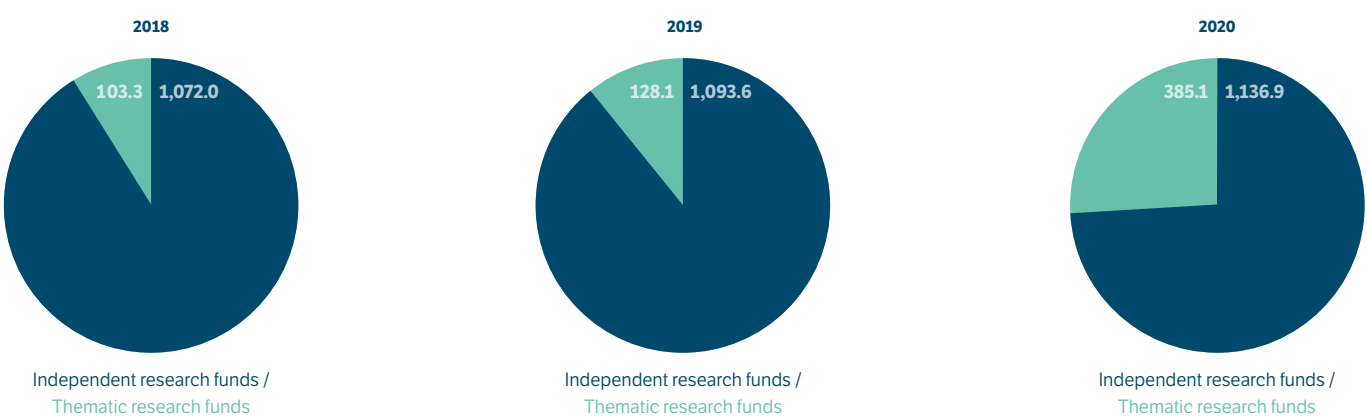


DEVELOPMENT IN NATIONAL BUDGET FINANCING

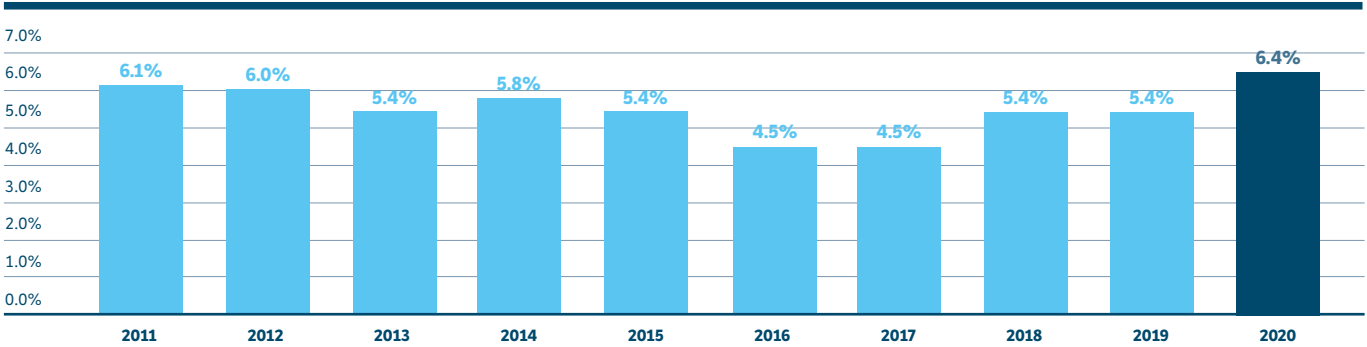
Independent Research Fund Denmark: National budget financing 2011-2020 (current prices m. DKK)



Distribution between thematic and independent research funds 2018-2020 (current prices, m. DKK)



National budget financing for DFF as share of total public research budget 2011-2020 (%)



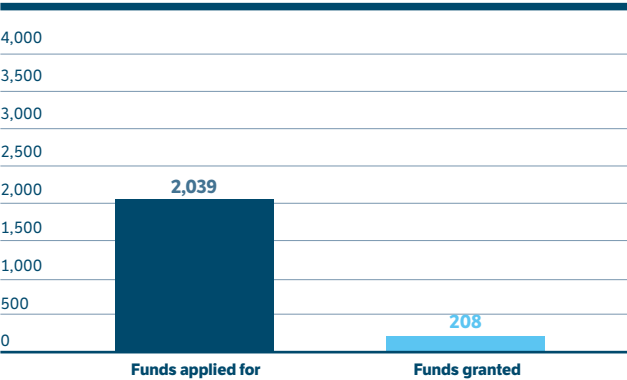
In 2019 Independent Research Fund Denmark celebrated the funding of

10,000 research ideas

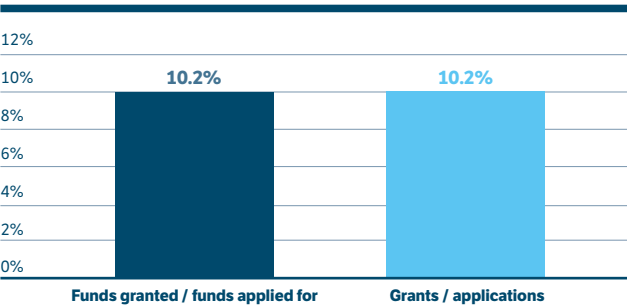
from 2004 to 2019

SELECTED INSTRUMENTS

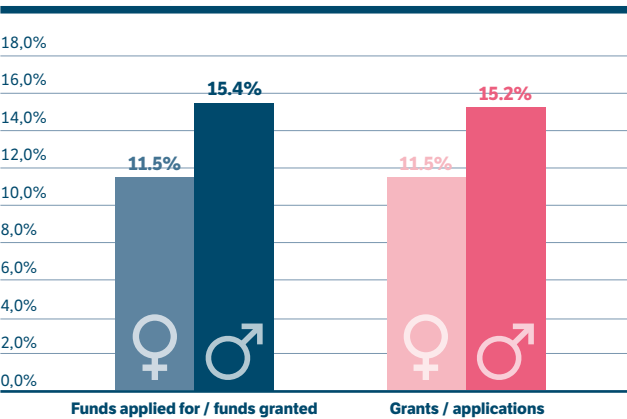
Sapere Aude: DFF-Starting Grant, funds applied for and granted 2019 (m. DKK)



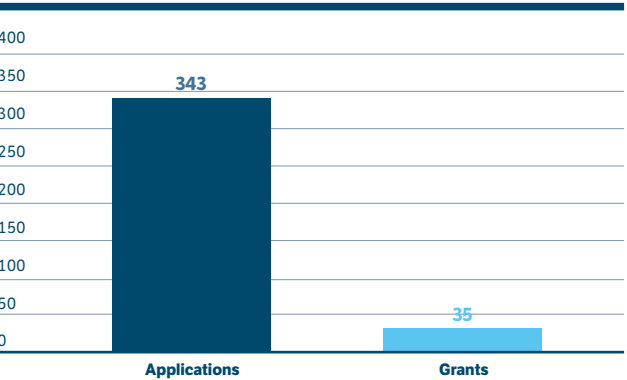
Sapere Aude: DFF-Starting Grant, success rates 2019 (%)



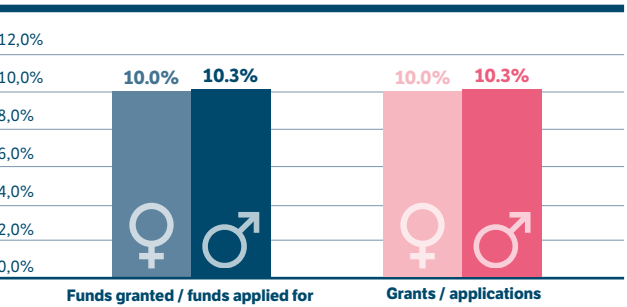
DFF-Research Project 1, success rates distributed on gender 2019 (%)



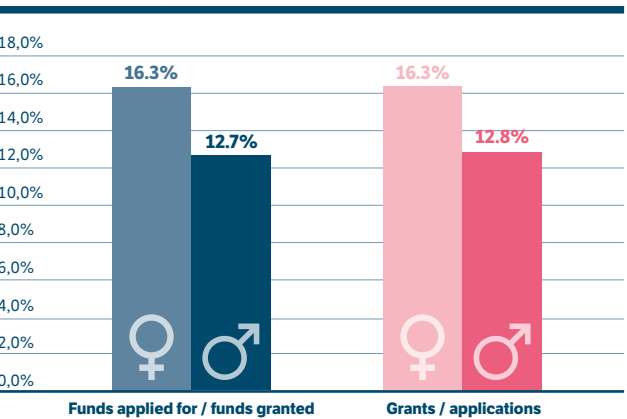
Sapere Aude: DFF-Starting Grant, applications and grants 2019 (number)



Sapere Aude: DFF-Starting Grant, success rates distributed on gender 2019 (%)



DFF-Research Project 2, success rates distributed on gender 2019 (%)



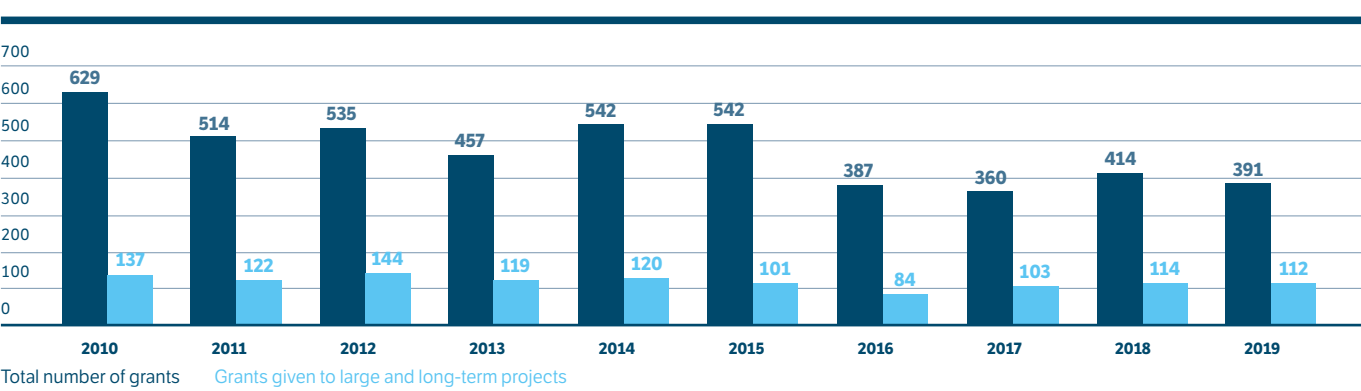
ONGOING RESEARCH PROJECTS

Ongoing projects and grants (number)

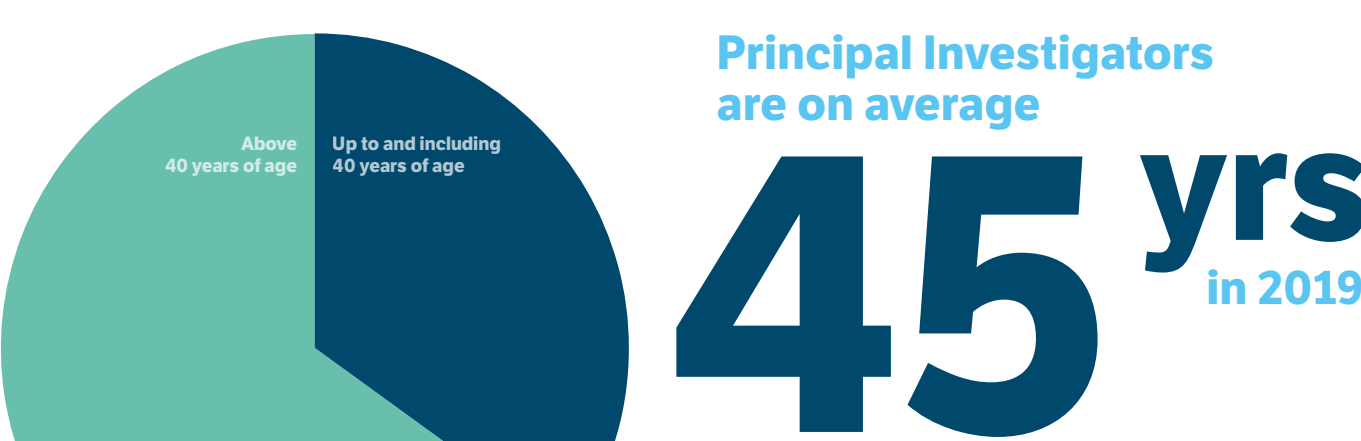


ADDITIONAL NUMBERS

Total number of grants and grants given to large and long-term projects (above DKK 3 m.) 2010-2019



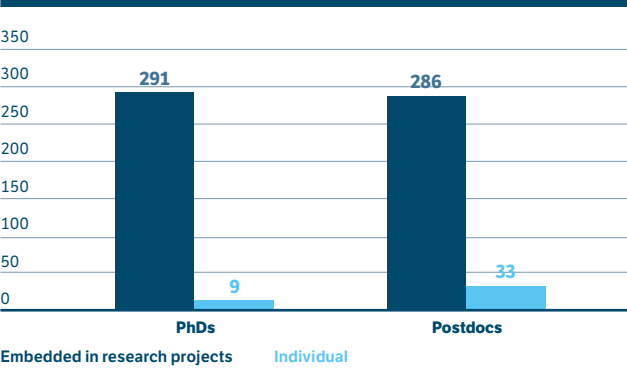
Age distribution for principal investigators 2019



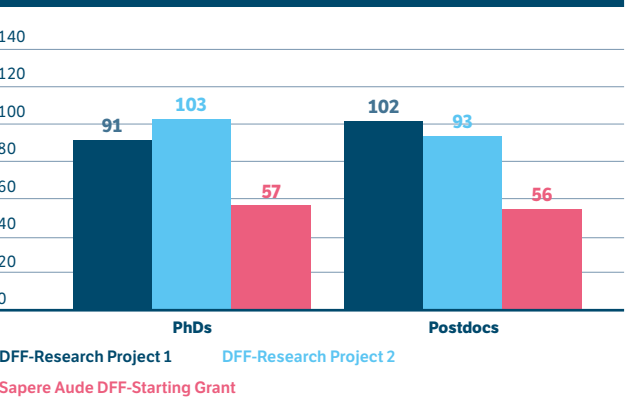
Age distribution for principal investigators 2019 distributed on instrument – above and under 40 yrs

Instrument	≤40	40<	Avg. age
DFF-Research Project 1	35	124	48
DFF-Research Project 2	3	64	50
Sapere Aude: DFF-Starting Grant	31	4	38
DFF-International Postdoc	29	4	33
Non-university research education (PhD)	8	1	31
Research networks Humanities	1	4	49
Journals Humanities	0	5	57
International research stay Social Sciences	6	3	41
Clinician scientist position Medical Sciences	4	4	44
Pre-graduate scholarship Medical Sciences	3	10	48
Graduate Research Opportunities Worldwide (GROW)	0	1	46
Total	120	224	45

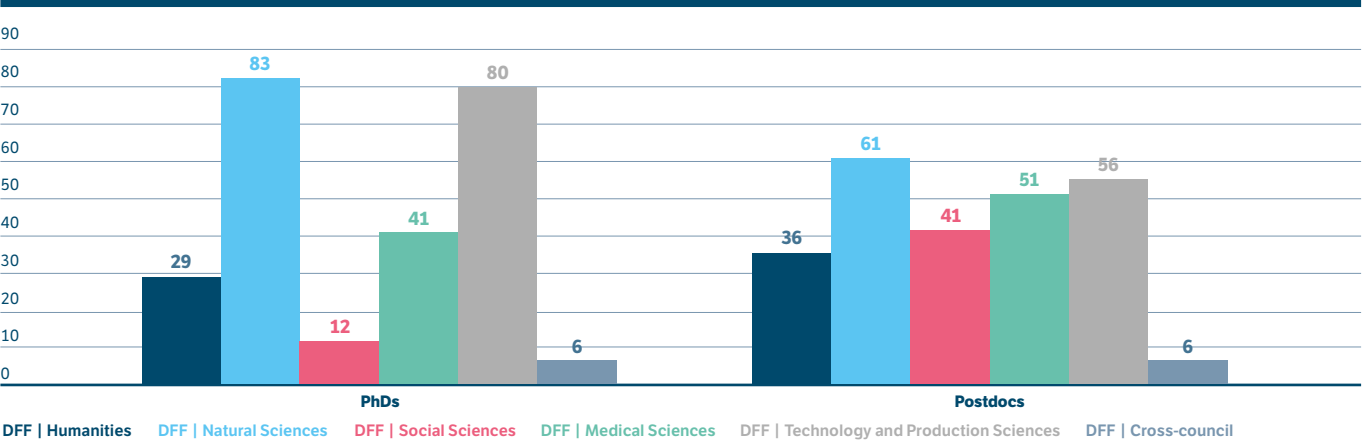
PhDs and postdocs, embedded and individual 2019 (number)



Embedded PhDs and postdocs distributed on instruments 2019 (number)



Embedded PhDs and postdocs distributed on councils 2019 (number)



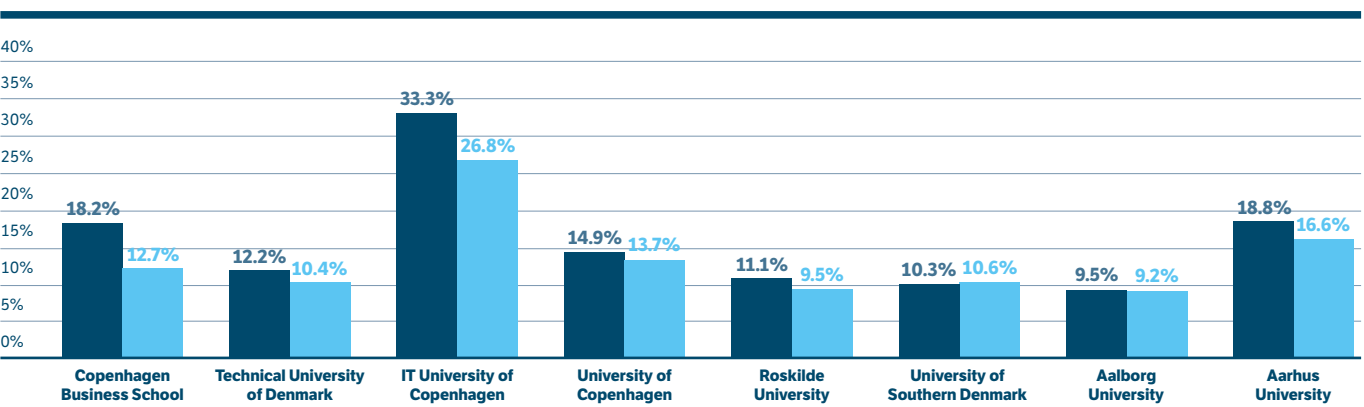
Applications and grants with interdisciplinarity within individual councils 2019 (%)

Council	Applications	Grants
DFF Humanities	33%	36%
DFF Natural Sciences	45%	46%
DFF Social Sciences	60%	52%
DFF Medical Sciences	61%	62%
DFF Technology and Production Sciences	34%	34%
DFF in total	47%	47%

Applications and grants with interdisciplinarity across individual councils 2019 (%)

Council	Applications	Grants
DFF Humanities	60%	44%
DFF Natural Sciences	35%	30%
DFF Social Sciences	28%	25%
DFF Medical Sciences	47%	46%
DFF Technology and Production Sciences	63%	64%
DFF in total	47%	43%

Universities and success rates (%)



Universities

Universities	Applications	Grants	Success rate	Funds applied for, m. DKK	Funds granted, m. DKK	Success rate	Avg. grant, m. DKK
Copenhagen Business School	55	10	18.2%	206.7	26.3	12.7%	2.6
Technical University of Denmark	335	41	12.2%	1,326.0	138.2	10.4%	3.4
University of Copenhagen	27	9	33.3%	110.3	29.5	26.8%	3.3
University of Copenhagen	726	108	14.9%	2,736.2	373.7	13.7%	3.5
Roskilde University	63	7	11.1%	248.7	23.8	9.5%	3.4
University of Southern Denmark	261	27	10.3%	956.1	101.4	10.6%	3.8
Aalborg University	168	16	9.5%	643.9	59.2	9.2%	3.7
Aarhus University	568	107	18.8%	2,075.2	343.9	16.6%	3.2
Subtotal	2,203	325	14.8%	8,303.1	1,096.0	13.2%	3.4
Other institutions and organisations ¹	444	66	14.9%	1,107.2	136.7	12.4%	2.1
Total	2,647	391	14.8%	9,410.3	1,232.8	13.1%	3.2

¹ Other institutions and organisations consist among others of Danish hospitals (including university hospitals), archives, museums, libraries, GTS-institutes, sector research institutions, other public institutions, private non-profit organisations and funds, foreign universities and foreign public institutions.

About Independent Research Fund Denmark

Independent Research Fund Denmark funds and supports the most original ideas and initiatives in Danish research.

In 2019, the fund allocated 391 grants for research projects amounting to a total of approximately DKK 1.2 million. The grants are given to research activities that originate from the researchers' own ideas.

The Fund's means are offered in open national competition without thematic and academic limitations. Scientific quality is the

most important assessment criterion for the allocation of funding, which primarily goes to innovative research projects with an average grant size of DKK 3.2 million.

The Fund continually works to create the best conditions for independent research in Denmark and to strengthen international research collaboration. Among other things, this happens through participation in the research policy debate and academic counseling, which the Fund provides for the Minister for Higher Education and Science, the

Danish Parliament, the government, and other requisitioners. Also, the Fund is in ongoing dialogue with significant partners to ensure that Danish research leads to the best possible results.

Independent Research Fund Denmark continually monitors its investments and is actively engaged in strengthening the application of research results and making visible the beneficial effects of research on society.

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Annual Report 2019

**Annual report of Independent
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Editor: Mette Lynge Hansen

**Independent Research Fund Denmark
Danish Agency for Science
and Higher Education**

Asylgade 7
5000 Odense C
+45 7231 8200
E-mail: dff@ufm.dk
www.dff.dk

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